SOILS INVESTIGATION
LAHAINA PLANNED COMMUNITY PROJECT
VILLAGE I, PHASE IA
AND OFFSITE SEWER LINE
LAHAINA, MAUI, HAWAII

for

HOUSING FINANCE & DEVELOPMENT CORPORATION

W.O. 90-2044.2
May 6, 1991

EH
ERNEST K. HIRATA & ASSOCIATES, INC.

EH

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May 6, 1991
W.O. 90-2044.2

Housing Finance & Development Corporation
Seven Waterfront Plaza
500 Ala Moana Boulevard, Suite 300
Honolulu, Hawaii 96813

Attention: Mr. Neal Wu

Gentlemen:

Our report, "Soils Investigation, Lahaina Planned Community Project, Village I, Phase IA, and Offsite Sewer Line, Lahaina, Maui, Hawaii," dated May 6, 1991, our Work Order 90-2044.2 is enclosed. This investigation was conducted in general conformance with the scope of work presented in our proposal dated July 31, 1990.

The surface soil covering the site was classified as reddish brown silty clay. The silty clay was in a stiff condition and extended to depths ranging from 5 to 7.5 feet in the subdivision site, and 7 to 9.5 feet along the sewer line alignment. Numerous cobbles and boulders were encountered throughout the surface layer. The silty clay in boring B27 was underlain by 4 feet of dark brown volcanic cinders. Underlying the surface silty clay was medium hard to hard basalt, extending to the maximum depths drilled.

Groundwater was encountered at depths of 8.5 feet and 5 feet in borings B32 and B33, respectively. Neither groundwater nor seepage was encountered in the remaining borings.

Geotechnical recommendations for development of the residential subdivision and offsite sewer line are presented in this report. Included are recommendations for site grading as well as for design of residential foundations, floor slabs, resistance to lateral pressures, flexible pavement, pipe support, trench excavation, and backfill.

We appreciate this opportunity to be of service. Should you have any questions concerning this report, please feel free to call on us.

Very truly yours,

Ernest K. Hirata & Associates, Inc.

Ernest K. Hirata
President

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SOILS INVESTIGATION
LAHAINA PLANNED COMMUNITY PROJECT
VILLAGE I, PHASE IA
AND OFFSITE SEWER LINE
LAHAINA, MAUI, HAWAII

INTRODUCTION

This report presents the results of our soils investigation performed for Village I, Phase IA of the Lahaina Planned Community Project, and a portion of the offsite sewer line which will connect Village I to the existing Pump Station No. 3, along Honoapiilani Highway. The purpose of this investigation was to determine the nature of the soils underlying the site, to ascertain their engineering properties, and to provide geotechnical recommendations for site grading, as well as the design of foundations, floor slabs, resistance to lateral pressures, flexible pavement, sewer pipe support, trench excavation, and backfill.

This investigation included drilling four exploratory test borings in the Phase IA subdivision area and three borings along the sewer line alignment. In addition, our work included obtaining representative soil samples, selected laboratory testing and analysis, and the preparation of this report. The general location of the project sites is shown on the enclosed Location Map, Plate 1. The approximate exploratory boring locations are shown on the Site Plans, Plates 2A and 2B. Also attached is an Appendix which describes the laboratory testing procedures.

PROJECT CONSIDERATIONS

Village I, Phase IA

The project will consist of a residential subdivision covering an area of approximately 15 acres. The project will include approximately 105 one and two story single family dwellings. Relatively light building loads are expected. Construction of roadways servicing the development will also be included in the project.

Grading for the project will consist of both cutting and filling. Cuts and fills will range up to 10 feet in height. Retaining walls may be required in some areas of the project.

Offsite Sewer Line

The proposed sewer line will extend from Village I to the existing Pump Station No. 3, along Honoapiilani Highway. The length of the line will be approximately 3,300 linear feet. The sewer line invert was not established at the time of this report.

SITE CONDITIONS

Village I, Phase IA

The project site is located on the east side of Honoapiilani Highway north of the town of Lahaina, Maui. The site is bordered to the west by the Lahaina Civic Center, and to the south by residential homes. A paved cane haul road bisects the eastern portion of the site, in a north -

south alignment.

The area is presently covered by cultivated sugar cane. Unpaved cane haul roads bisect the site in an east - west direction. Total relief over the site is on the order of 115 feet with drainage generally flowing in a westerly direction.

Offsite Sewer Line

The site is located along a portion of Honoapiilani Highway fronting Wahikuli State Wayside Park, in Lahaina, Maui. Total length of the site is approximately 3300 linear feet. The project area is primarily occupied by sugar cane fields and a residential subdivision.

FIELD EXPLORATION

The site was explored between October 31, 1990, and April 3, 1991, by drilling seven exploratory test borings with a truck mounted drilling machine. The borings were drilled as part of our fieldwork for the Lahaina Planned Community project, and were therefore identified as borings B27 through B33. Four borings were drilled in the Village I, Phase IA subdivision site, and three borings were drilled along the sewer line alignment.

The borings varied in depth from 13 to 20 feet. The soils were continuously logged by our field engineer and classified by visual examination in accordance with the Unified Soil Classification System. The approximate boring locations are shown on Plates 2A and 2B, and the soils encountered are logged on Plates A1 through A7.

Undisturbed, bag, and core samples were recovered from the borings for selected laboratory testing and analyses. Undisturbed samples were obtained by driving a 3 inch O.D. thin-walled split tube sampler with a 140 pound hammer from a height of 30 inches. Core samples were obtained by drilling with an NX core barrel having an inside diameter of 2.5 inches. The blow count required for twelve inches of penetration and recovery percentages for each core run are shown on the enclosed Boring Logs.

Rock quality designations (RQD) are also shown on the Boring Logs. This is a modified core recovery procedure which takes into account the number of fractures observed in the core samples. Only pieces 4 inches in length or longer are included in determining the core recovery. Breaks caused by handling are ignored. The following is a general correlation between RQD percentages and rock quality.

RQD (%)	Description of Rock Quality
0 - 25	Very Poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Reference: Tunnel Engineering Handbook, Bickel/Kuesel

SOIL CONDITIONS

Village I, Phase IA

The surface soil covering the site was classified as reddish brown silty clay. The silty clay was in a stiff condition and extended to depths ranging from 5 to 7.5 feet. Numerous cobbles and boulders were encountered throughout the surface layer. CBR testing on the silty clay indicated that the soil is only slightly expansive.

The silty clay in boring B27 was underlain by 4 feet of dark brown volcanic cinders. The cinders were in a dense to very dense condition.

The surface soils were underlain by a stratum of gray basalt at depths ranging from 2.5 to 9 feet. The basalt was in a medium hard to hard condition and extended to the maximum depths drilled.

Neither groundwater nor seepage was encountered in our borings.

Offsite Sewer Line

The surface soil along the sewer line alignment was classified as reddish brown silty clay. The soil was in a stiff condition, with boulders encountered at varying depths throughout the stratum.

Underlying the silty clay was hard basalt at depths ranging from 7 to 9.5 feet. The basalt stratum extended to the maximum depths drilled.

Groundwater was encountered at depths of 8.5 feet and 5 feet in borings B32 and B33, respectively. Groundwater was not encountered in boring B31.

CONCLUSIONS AND RECOMMENDATIONS

I. Expansive Soils

Expansion tests were conducted on undisturbed samples of the onsite silty clay. Test results indicate only a slight expansion potential, and as a result, additional precautionary measures will not be required for building foundations and slabs on grade.

II. Groundwater

Neither groundwater nor seepage conditions were encountered in our exploratory borings at the Village I, Phase IA site. As a result, we believe that groundwater will not impact the proposed development. However, subdrains should be placed in gullies or natural drainage ways which will be filled.

III. Site Grading

A. Site Preparation

The project site should be cleared of all vegetation and other deleterious material, and be wasted from the area. Soft or loose material at the bottom of drainage ditches should be removed prior to placement of fill. The existing ground should be scarified to a depth of six inches and compacted to a minimum 90 percent compaction as determined by ASTM D 1557-78.

B. Fill Material

The onsite silty clay may be reused in compacted fills provided all rock fragments larger than six inches in maximum dimension are removed.

Any imported structural fill should consist of well-graded, non-expansive granular material. Specifications for imported structural fill should state that not more than 20 percent of soil by weight shall pass the #200 sieve. In addition, the P.I. of that portion of the soil passing the #40 sieve shall not be greater than 10. Yard fill necessary for landscaping need not adhere to these specifications.

C. Fill Placement

Compacted fill should be placed in horizontal lifts restricted to eight inches in loose thickness and compacted to a minimum of 90 percent compaction as determined by ASTM D 1557-78. Fill placed in areas which slope steeper than 5:1 (horizontal to vertical), should be continually benched as the fill is brought up in lifts.

D. Slope Stability

Both cut and fill slopes should be stable at gradients of 2:1 (horizontal to vertical) or flatter. Slopes exceeding 15 feet in height should included benches at least 8 feet in width. The benches should be constructed at intervals not exceeding 15 feet in vertical height. All slopes should be planted as soon as practical to minimize the effects of erosion and weathering.

E. Rippability

Excavations into the surface silty clay can be made with conventional earth moving equipment. Large bulldozers equipped with rippers may be able to excavate portions of the underlying basalt stratum; however, excavations into the harder and less fractured sections may require pneumatic equipment.

F. Embankment Shrinkage

The average relative compaction of the near surface soil is slightly higher than 80 percent. We anticipate a shrinkage factor of approximately 10 to 15 percent due to compaction of the soil. In addition, the upper 12 inches of surface soil may be lost due to grubbing operations.

G. Transition Areas

Although the final building locations and finish grades were not available, we assume that parcels will be located in transition areas between cut and fill. To minimize the potential for differential settlement of structures and to provide more uniform support, we recommend that building sites in transition areas be overcut to a depth equal to the maximum thickness of fill, or to a maximum of two feet. The overexcavated soils should then be recompacted to the minimum compaction requirements.

IV. Building Foundations

Conventional spread footings or thickened slab type foundations founded on either the undisturbed silty clay or compacted fill may be used to support the structures. Foundations founded on the undisturbed silty clay may be designed for a bearing value of 3000 pounds per square foot. Foundations bearing on compacted fill may be designed for a bearing value of 2000 pounds per square foot.

Foundation excavations in some areas may also expose the underlying basalt stratum. Footings founded on basalt may be designed for a bearing value of 5000 pounds per square foot.

All footings supporting a building should be founded on the same soil type and designed for the same allowable bearing pressure. (See recommendations for "Transition Areas" in the Site Grading section of this report.)

All footings should be a minimum of 16 inches in width, and thickened slabs at least 12 inches wide. Footings should be embedded at least 18 inches below finish adjacent grade.

The bottom of all footing excavations should be cleaned of loose material and thoroughly tamped prior to placement of reinforcing steel and concrete.

Footings located on, or near the top of slopes, should be embedded such that a minimum horizontal distance of 5 feet is maintained between the bottom edge of footing and slope face.

V. Lateral Design

The bearing values indicated above are for the total of dead and frequently applied live loads, and may be increased by one-third for short duration loading which includes the effect of wind and seismic forces. Resistance to lateral loading may be provided by friction acting at the base of foundations and by passive earth pressure acting on the buried portions of foundations.

An allowable coefficient of friction of 0.4 may be used with the dead load forces. Passive earth pressure may be computed as an equivalent fluid having a density of 300 pounds per cubic foot with a maximum earth pressure of 3000 pounds per square foot. Unless covered by pavement or concrete slabs, the upper 12 inches of soil should not be considered in computing lateral resistance.

For active earth pressure considerations, equivalent fluid pressures of 40 and 55 pounds per cubic foot per foot of depth may be used for freestanding and restrained conditions, respectively.

To prevent buildup of hydrostatic pressures, weepholes or subdrains should be included in the design of all retaining structures.

VI. Settlement

Building loads were not available at the time of this report. However, relatively light structural loads are anticipated, and excessive settlement of foundations is not expected.

VII. Floor Slabs

To provide uniform support and a capillary break, all slabs on grade should be underlain by a four inch cushion of clean gravel, such as #3 Fine (ASTM Size 67). All building slabs should also be protected by a plastic moisture barrier placed between the slab and cushion material. A thin layer of sand should also be placed between the slab and moisture barrier to aid the curing process.

VIII. Pavement Design

A laboratory CBR test performed on the onsite silty clay resulted in a CBR value of 22 percent, and an expansion potential of 1.0 percent. Based on our test results, the following section may be used in the design of flexible pavements for roads. The subgrade, base course, select borrow should be compacted to a minimum of 95 percent compaction as determined by ASTM D 1557-78.

2.0"	Asphaltic Concrete
6.0"	Base Course
6.0"	Select Borrow
14.0"	Total Thickness

IX. Pipe Support

Conventional crushed rock cradles may be used to support the sewer line. The thickness of the crushed rock below the pipe should conform to the Standard Details for Public Works Construction. Crushed rock should also be placed along the sides of the pipe to cover at least the lower half of the pipe barrel.

The crushed rock material should conform to Section 15 of the Standard Specification for Public Works Construction. The use of ASTM Size No. 67 rock is recommended for the rock cradle.

X. Trench Excavation and Backfill

Based on our exploratory borings, we believe that trench excavations into the surface silty clay can be made with conventional earth moving equipment. Excavations into the underlying medium hard to hard basalt may require pneumatic equipment. The excavation sidewalls should stand at a near vertical gradient for temporary conditions. Shoring should not be necessary; however, it should be the Contractor's responsibility to conform to OSHA safety requirements.

Backfilling procedures should conform to the Standard Specifications for Public Works

Construction. This will require sandy or granular material with a maximum particle size of 1 inch placed to at least 12 inches above the pipe barrel. The material should be well-graded, with not more than 9 percent of the soil passing of the soil passing the No. 200 sieve.

The excavated onsite soils may be reused as backfill from 12 inches above the pipe barrel to 2 feet below finish grade provided all rock fragments larger than 6 inches are removed. The basalt should be crushed to a relatively well-graded material prior to being reused in compacted fills. This intermediate backfill section should be compacted in lifts to a minimum 90 percent compaction as determined by ASTM D 1557-78.

Backfill placed within 2 feet of finish grade should conform to Section 30 of the Standard Specifications for Public Work Construction. The onsite soils may be used provided all rock fragments larger than 3 inches are removed. This section should be compacted in lifts to a minimum 95 percent compaction as determined by ASTM D 1557-78.

XII. Construction Monitoring

The preparation of all footing excavations for placement of reinforcing steel and concrete should be monitored by an engineer from our staff. All structural fill placement should also be monitored and tested by personnel from our office.

XIII. Limitations

The boring logs indicate the approximate subsurface soil conditions encountered only at those times and locations where our borings were made, and may not represent conditions at other times and locations.

During construction, should subsurface conditions differ from those encountered in our borings, we should be advised immediately in order to review and to revise our recommendations.

Our professional services were performed, findings obtained, and recommendations prepared in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing under similar conditions. This warranty is in lieu of all other warranties expressed or implied.

Respectfully submitted,

Ernest K. Hirata & Associates, Inc.

Paul S. Morimoto, P.E.

This work was prepared by
me or under my supervision.

PSM:SRC

APPENDIX OF LABORATORY TESTING

Classification

Field classification is verified in the laboratory, also in accordance with the Unified Soil Classification System. Laboratory classification is determined by both visual examination and Atterberg Limit tests performed in general accordance with ASTM D423 and D424. The final classification is shown at the appropriate locations on the Boring Logs, Plates A1 through A7. Tests conducted on a sample obtained from boring B28 near the surface resulted in a liquid limit of 38 and a plasticity index of 14.

Moisture-Density

The field moisture content and dry unit weight are determined for each of the undisturbed samples. The information is useful in providing a gross picture of the soil consistency between borings and any local variations. The dry unit weight is determined in pounds per cubic foot while the moisture content is determined as a percentage of the dry unit weight. Samples are obtained from a 3 inch O.D. split tube sampler. Test results are shown at the appropriate depths on the Boring Logs, Plates A1 through A7.

Shear Tests

Shear tests are performed in the Direct Shear Machine which is of the strain control type. The rate of deformation is approximately 0.02 inches per minute. Each sample is sheared under varying confining loads in order to determine the Coulomb shear strength parameters, cohesion and angle of internal friction. Eighty percent of the maximum value is taken to determine the shear strength parameters. Test results are presented on Plate B1 and B2.

Proctor Tests

Proctor tests are performed on bag samples to determine the optimum moisture content at which each soil type compacts to 100 percent density. The tests are performed in general accordance with ASTM D 1557-78, and results are shown on Plate C.

California Bearing Ratio Tests

CBR tests are performed on bag samples to evaluate the relative quality of subgrade soils to be used in the design of flexible pavements. The tests are performed in general accordance with ASTM D 1883-73, and results are shown on Plate D.

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BORING LOG

W.O. 90-2044.2

BORING NO. B27 DRIVING WT. 140 lb. DATE OF DRILLING 4-3-91
SURFACE ELEV. 36± DROP 30 in. WATER LEVEL None

DEPTH (FEET)	GRAPH SYMBOL	UNIFIED SOIL CLASSIFICATION	BLOWS/FT.	DRY DENSITY (PCF.)	MOISTURE CONTENT (%)	RELATIVE COMPACTION (%)	DESCRIPTION
0		CL					Silty CLAY - Reddish brown, moist, stiff, with weathered basalt fragments.
			21	82	27		
			50/6"	71	23		Cobbles encountered from 3 to 5 feet.
5		SP	80/10"	89	27		VOLCANIC CINDERS - Dark brown to reddish brown, moist, dense to very dense, with some clay.
			50/6"	No Recovery			BASALT - Gray, hard, vesicular.
10							Begin NX Coring from 10 feet.
							100% Recovery from 10 to 15 feet. RQD=80%
15							90% Recovery from 15 to 20 feet. RQD=73%
20							End boring at 20 feet.
25							
30							

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BORING LOG

W.O. 90-2044.2

BORING NO. B28 DRIVING WT. 140 lb. DATE OF DRILLING 11-1-90

SURFACE ELEV. 105± DROP 30 in. WATER LEVEL None

DEPTH (FEET)	GRAPH SYMBOL	UNIFIED SOIL CLASSI-FICATION	BLOWS/FT.	DRY DENSITY (PCF.)	MOISTURE CONTENT (%)	RELATIVE COMPAC-TION (%)	DESCRIPTION
0		CL					Silty CLAY - Reddish brown, slightly moist, stiff.
			65/8"	78	15		Boulder encountered from 1.5 to 4 feet.
5			64	Tip Recovery			Grading to mottled brown color with weathered basalt fragments from 4 feet.
							BASALT - Gray, medium hard to hard, highly fractured. Begin NX coring from 5.5 feet. 100% Recovery from 5.5 feet to 10 feet. RQD = 11% Grading to mottled orange brown color and highly vesicular from 10 feet. 72% Recovery from 10 to 15 feet. RQD = 20%
10							
15							End boring at 15 feet.
20							
25							
30							

Plate A2

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BORING LOG

W.O. 90-2044.2

BORING NO. B29 DRIVING WT. 140 lb. DATE OF DRILLING 1-23-91
SURFACE ELEV. 173± DROP 30 in. WATER LEVEL None

DEPTH (FEET)	GRAPH SYMBOL	UNIFIED SOIL CLASSIFICATION	BLOWS/FT.	DRY DENSITY (PCF.)	MOISTURE CONTENT (%)	RELATIVE COMPACTION (%)	DESCRIPTION
0		CL					Silty CLAY - Reddish brown, moist, stiff. Grading with cobbles and boulders from 1 foot.
5							BASALT - Gray, hard, vesicular, highly fractured. Begin NX coring from 4 feet. 64% Recovery from 4 to 9 feet. RQD = 48% 100% Recovery from 9 to 13 feet. RQD = 0% 97% Recovery from 13 to 17 feet. RQD= 25%
10							
15							
							End boring at 17 feet.
20							
25							
30							

Plate A3

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BORING LOG

W.O. 90-2044.2

BORING NO. B30 DRIVING WT. 140 lb. DATE OF DRILLING 10-31-90
SURFACE ELEV. 35± DROP 30 in. WATER LEVEL None

DEPTH (FEET)	GRAPH SYMBOL	UNIFIED SOIL CLASSIFICATION	BLOWS/FT.	DRY DENSITY (PCF.)	MOISTURE CONTENT (%)	RELATIVE COMPACTION (%)	DESCRIPTION
0		CL	97/9"	92	15		Silty CLAY - reddish brown, moist, stiff, with basalt cobbles and boulders. Begin NX coring from 3.5 feet. 70% Recovery from 3.5 to 8.5 feet. RQD=40%
5							
10							BASALT - Gray, hard, slightly vesicular. 100% Recovery from 8.5 to 13.5 feet. RQD=62%
15							End boring at 13.5 feet.
20							
25							
30							

Plate A4

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BORING LOG

W.O. 90-2044.2

BORING NO. B31 DRIVING WT. 140 lb. DATE OF DRILLING 10-31-90

SURFACE ELEV. 14± DROP 30 in. WATER LEVEL None

DEPTH (FEET)	GRAPH SYMBOL	UNIFIED SOIL CLASSI-FICATION	BLOWS/FT.	DRY DENSITY (PCF.)	MOISTURE CONTENT (%)	RELATIVE COMPAC-TION (%)	DESCRIPTION
0		CL					Silty CLAY - Reddish brown, slightly moist, stiff, with basalt cobbles.
			30/Tip	Recovery			Boulder encountered at 1.5 to 3 feet.
			35	95	26		
5			50/5"	105	15		Grades with highly weathered rock from 6.25 feet.
							BASALT - Gray, slightly vesicular, slightly fractured, hard. Begin NX Coring from 8.5 feet. 100% Recovery from 8.5 to 13.5 feet. RQD=80%
10							Grades moderately weathered with reddish brown color, dense to medium hard from 11.5 feet.
							End boring at 13 feet.
15							
20							
25							
30							

Plate A5

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BORING LOG

W.O. 90-2044.2

BORING NO. B32 | DRIVING WT. 140 lb. | DATE OF DRILLING 10-24-90

SURFACE ELEV. 10± | DROP 30 in. | WATER LEVEL @ 8.5 ft.

DEPTH (FEET)	GRAPH SYMBOL	UNIFIED SOIL CLASSIFICATION	BLOWS/FT.	DRY DENSITY (PCF.)	MOISTURE CONTENT (%)	RELATIVE COMPACTION (%)	DESCRIPTION
0		CL	50/4"	86	13		Silty CLAY - Reddish brown, slightly moist, stiff with basalt gravels. Cobbles and boulders encountered from 2 feet.
			50/5"	92	20		
5			50/3"	110	17		
10							BASALT - Gray, slightly vesicular, slightly fractured, with highly weathered seams. Begin NX Coring from 8.5 feet. 100% Recovery from 8.5 to 13.5 feet. RQD=56%
15							End boring at 13.5 feet
20							
25							
30							

Plate A6

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99-1433 Koaha Place * Aiea, Hawaii 96701-1028 * Phone 486-0787

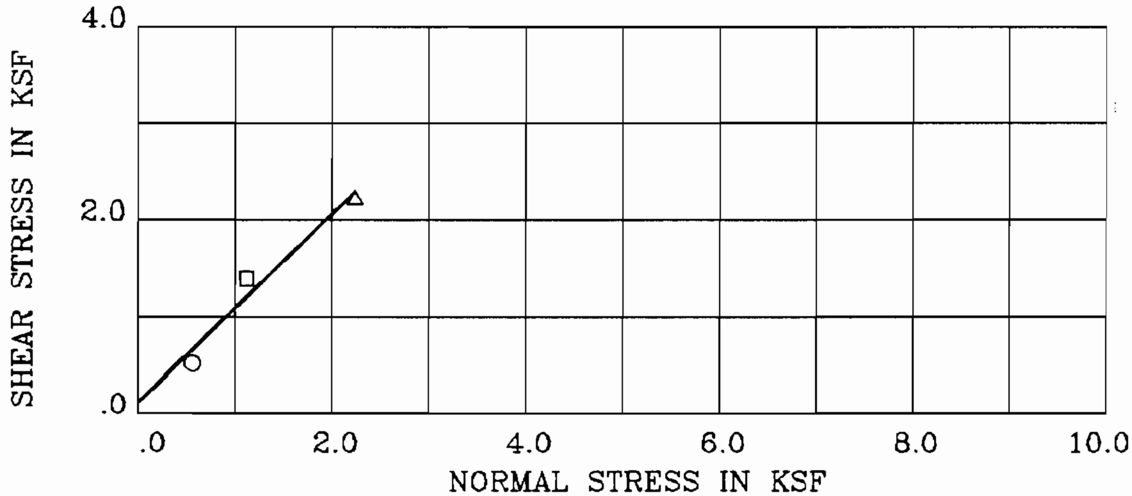
BORING LOG

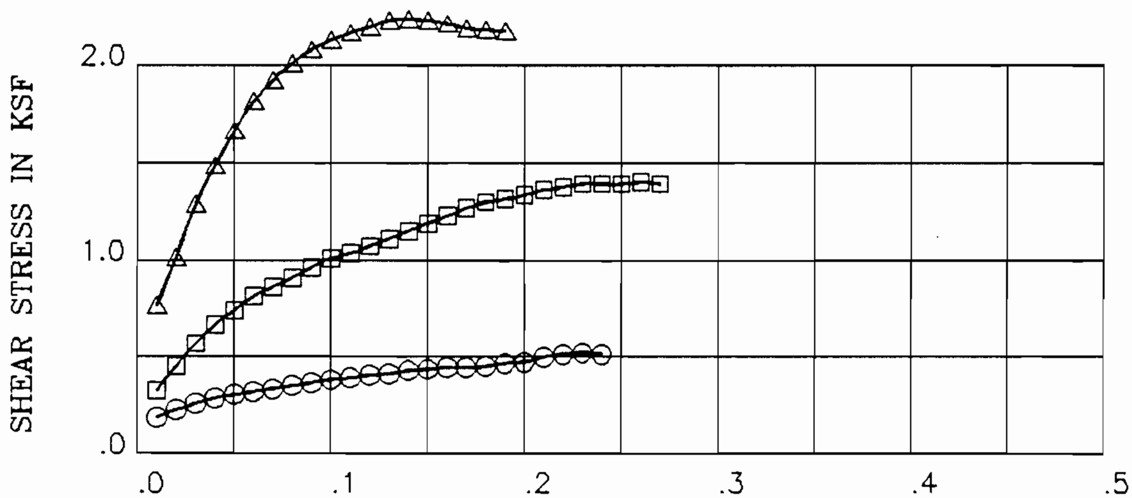
W.O. 90-2044.2

BORING NO. B33 | DRIVING WT. 140 lb. | DATE OF DRILLING 10-23-90
SURFACE ELEV. 8± | DROP 30 in. | WATER LEVEL @ 5.0 ft.

DEPTH (FEET)	GRAPH SYMBOL	UNIFIED SOIL CLASSIFICATION	BLOWS/FT.	DRY DENSITY (PCF.)	MOISTURE CONTENT (%)	RELATIVE COMPACTION (%)	DESCRIPTION
0		CL					Silty CLAY - Reddish brown, moist stiff, with traces of volcanic cinders.
			37	116	11		
			30	99	9		
			22/6"	No Recovery			Boulder encountered at 5 feet.
			50/5"	105	26		BASALT - Gray, hard, slightly vesicular, with highly weathered fractures.
10							Begin NX Coring from 10.5 feet.
							100% Recovery form 10.5 to 15 feet. RQD=52%
							Highly fractured from 12.5 to 14.5 feet.
15							End boring at 15 feet.
20							
25							
30							

Plate A7





BORING/SAMPLE : B30 DEPTH (ft) : 1

DESCRIPTION : Reddish Brown Silty Clay

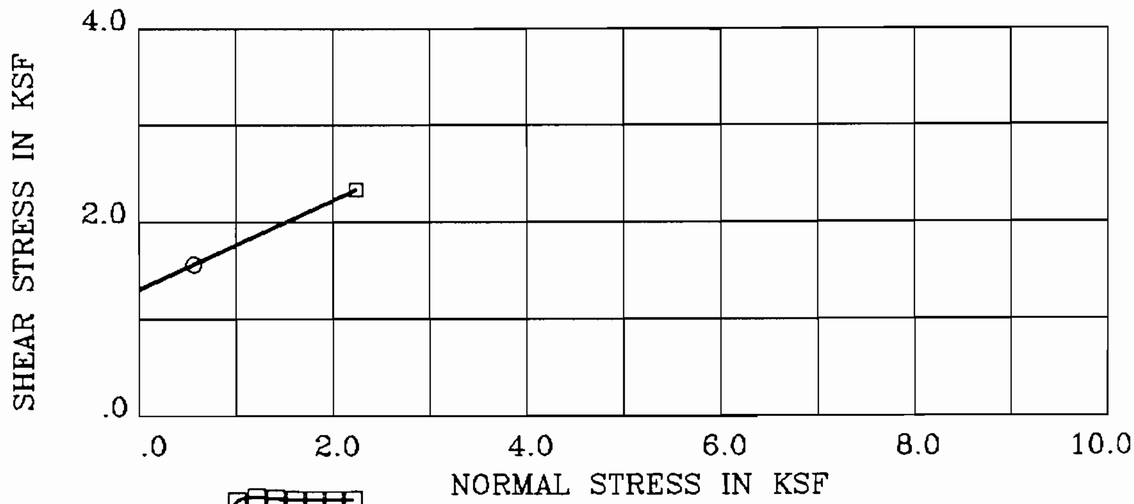
STRENGTH INTERCEPT (C) : .105 KSF (PEAK STRENGTH)

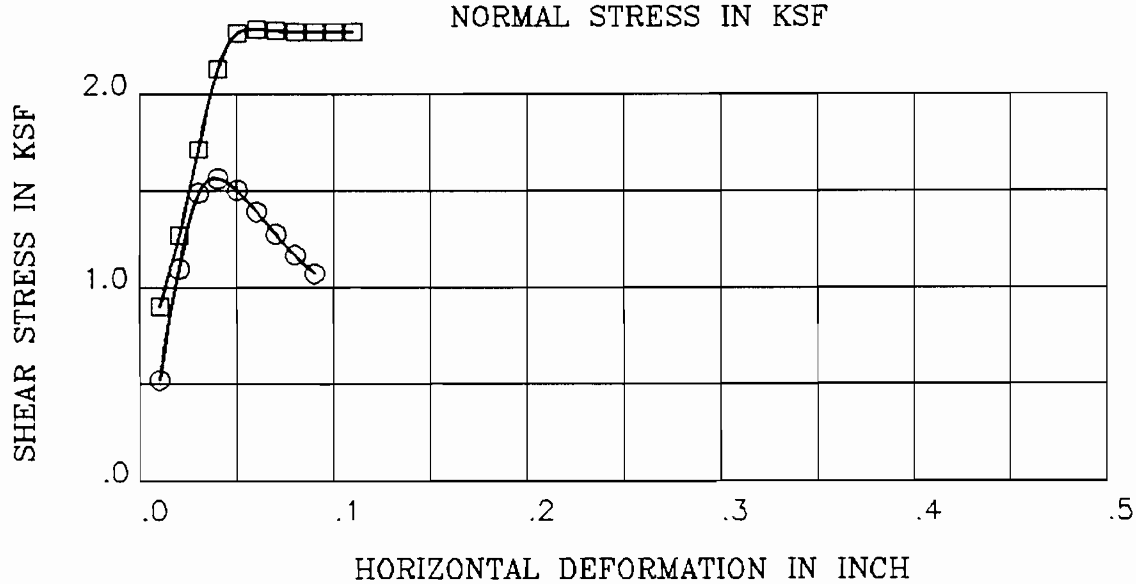
FRICTION ANGLE (PHI) : 44.4 DEG (PEAK STRENGTH)

SYMBOL	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	VOID RATIO	NORMAL STRESS (ksf)	PEAK SHEAR (ksf)	RESIDUAL SHEAR (ksf)
○	15.1	91.8	.836	.56	.52	.52
□	15.1	91.8	.836	1.12	1.40	1.39
△	15.1	91.8	.836	2.24	2.23	2.17

Remark : Date: 11/6/90

W.O. 90-2044.2	Village 1 Phase A – Lahaina Project
Ernest K. Hirata & Associates, Inc.	DIRECT SHEAR TEST **Plate B1**



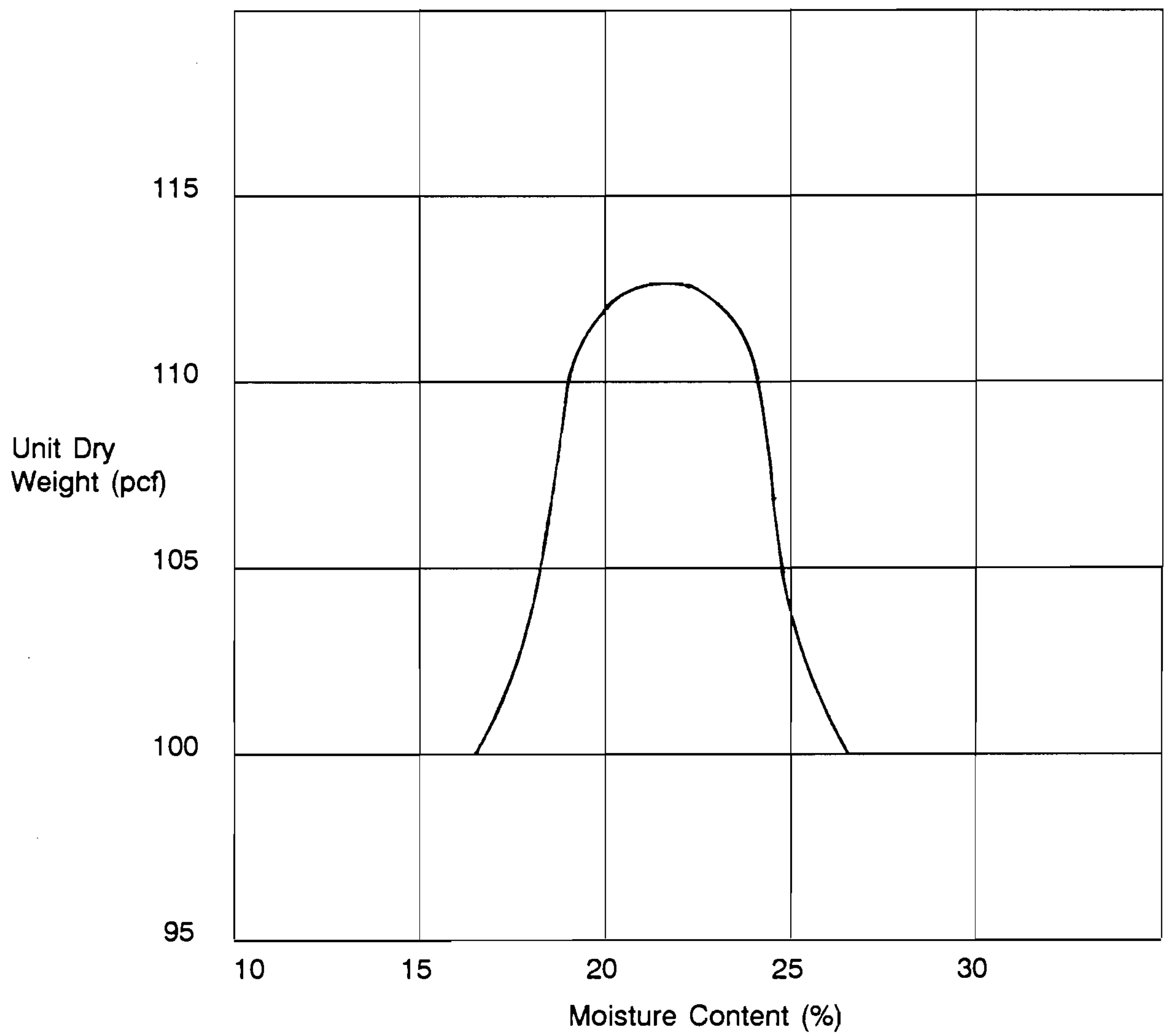


BORING/SAMPLE	: B32		DEPTH (ft)	:	5
DESCRIPTION	: Reddish Brown Silty Clay				
STRENGTH INTERCEPT (C)	:	1.307	KSF		(PEAK STRENGTH)
FRICTION ANGLE (PHI)	:	24.7	DEG		(PEAK STRENGTH)

SYMBOL	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	VOID RATIO	NORMAL STRESS (ksf)	PEAK SHEAR (ksf)	RESIDUAL SHEAR (ksf)
O	17.1	109.8	.534	.56	1.56	1.07
□	17.1	109.8	.534	2.24	2.34	2.32

Remark : Date: 11/6/90

W.O. 90-2044.2	Offsite Sewer Line - Lahaina Project
Ernest K. Hirata & Associates, Inc.	DIRECT SHEAR TEST **Plate B2**



Soil Data

Location: Boring B30 at Surface

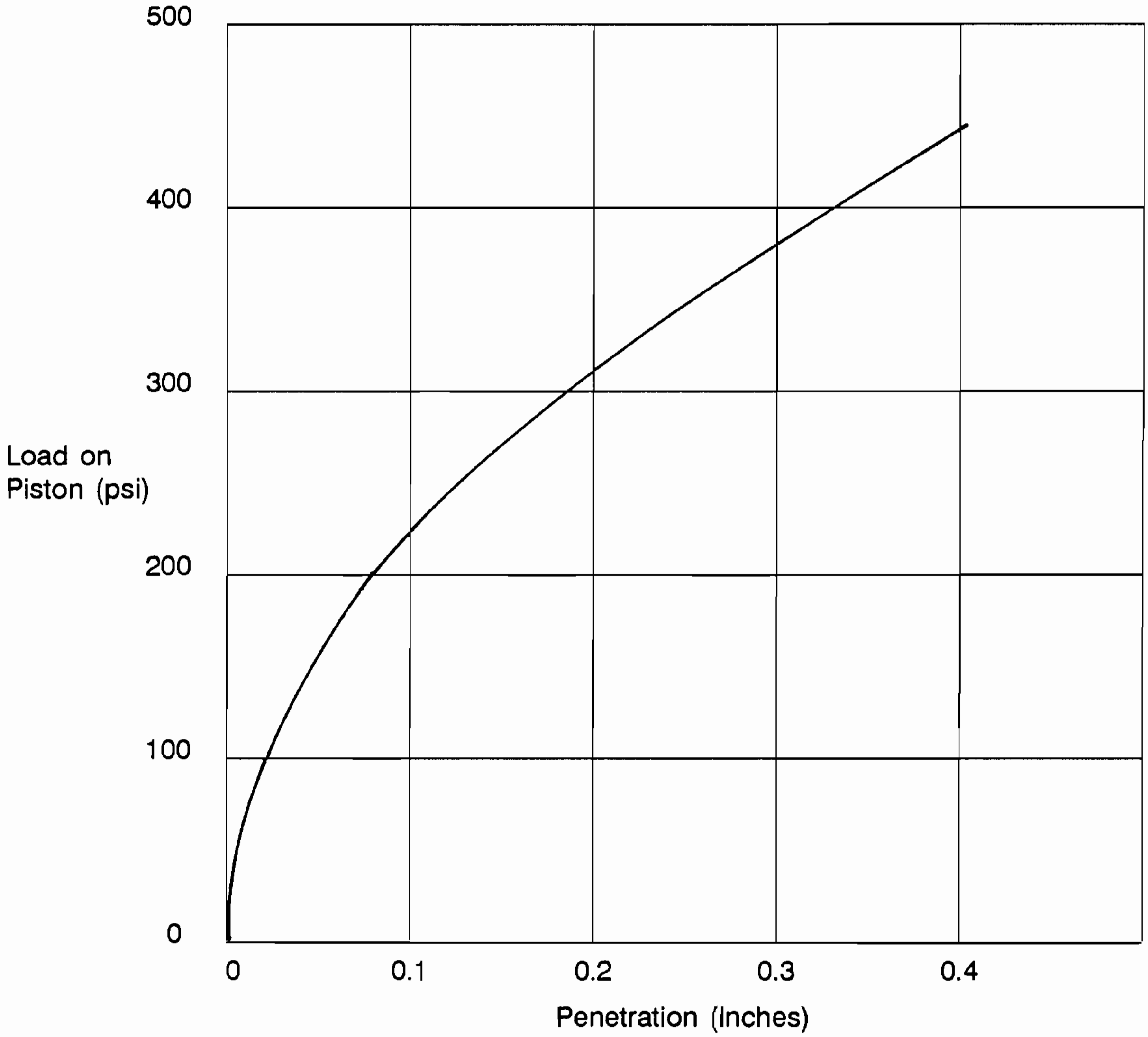
Description: Reddish Brown Silty Clay

Test Results

Maximum Density: 107.5 PCF

Optimum Moisture: 22.0%

W.O. 90-2044.2	Village I Phase A - Lahaina Project
ERNEST K. HIRATA & ASSOCIATES, INC.	MAXIMUM DENSITY CURVE Plate C



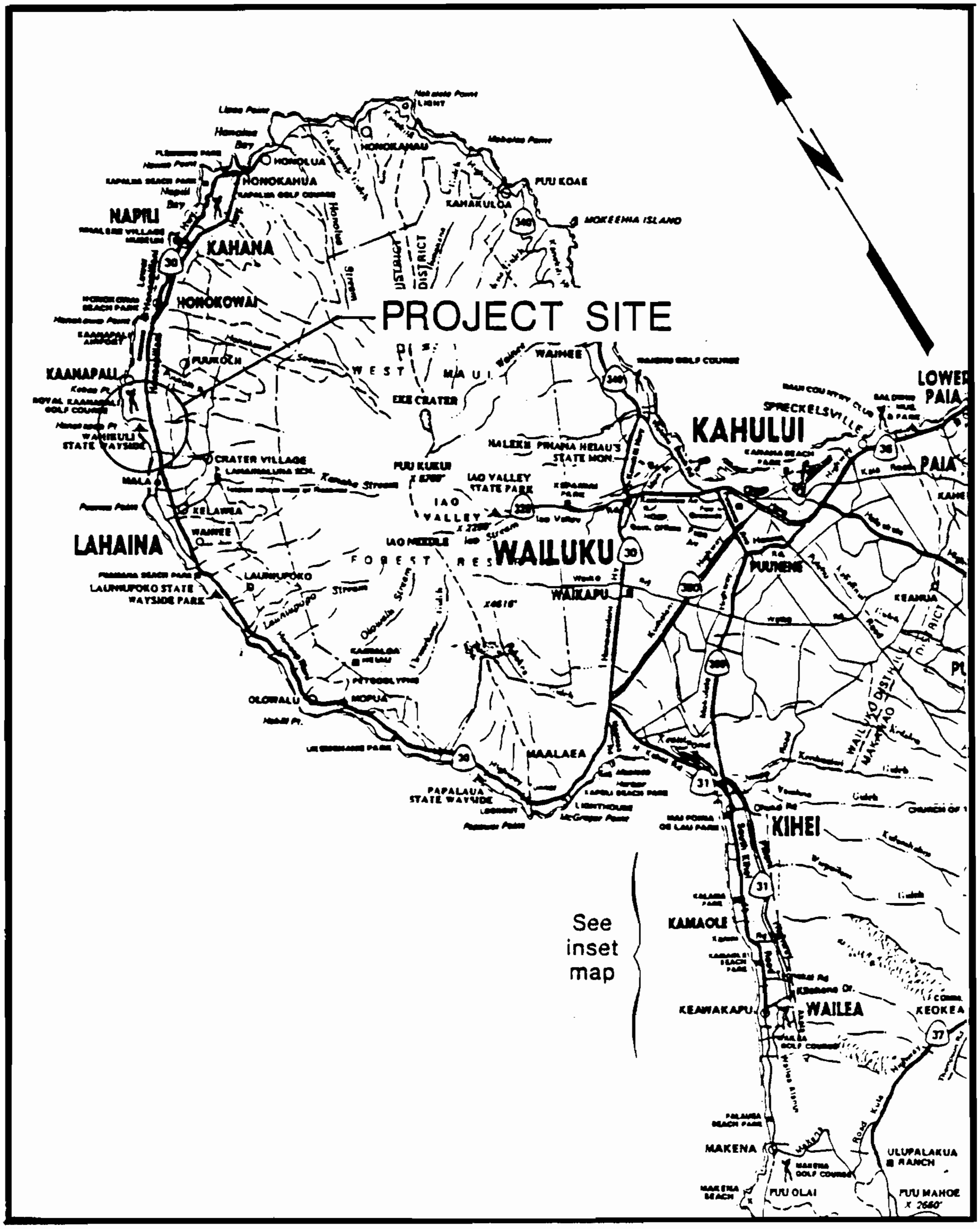
Soil Data

Location:	Boring B30 at 1'.
Description:	Reddish Brown Silty Clay
Maximum Density:	107.5 PCF
Optimum Moisture:	22.0%

Test Results

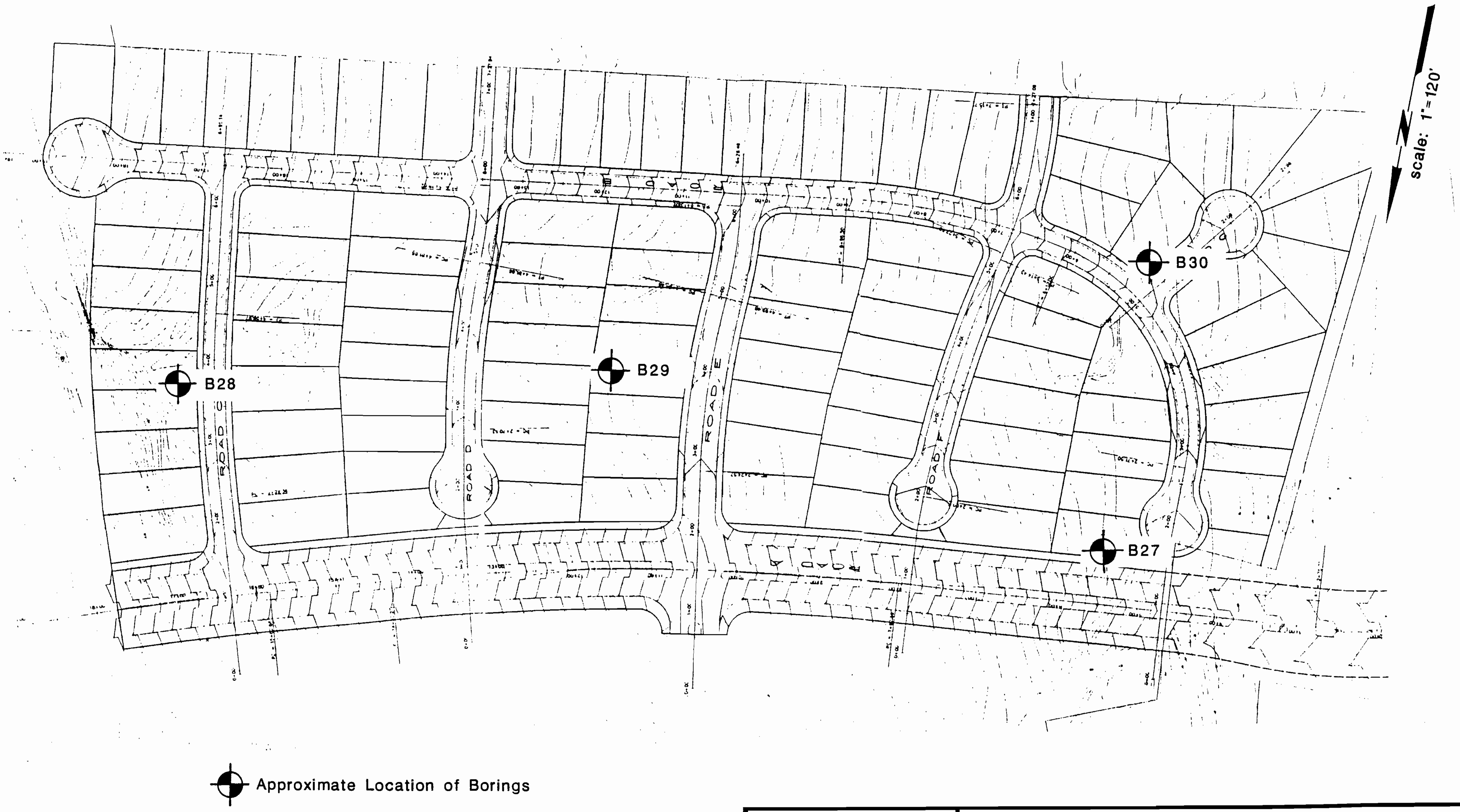
CBR Value: 22% Expansion: 1.0%

W.O. 90-2044.2	Village I Phase A - Lahaina Project	
ERNEST K. HIRATA & ASSOCIATES, INC.	CBR STRESS PENETRATION CURVE	Plate D

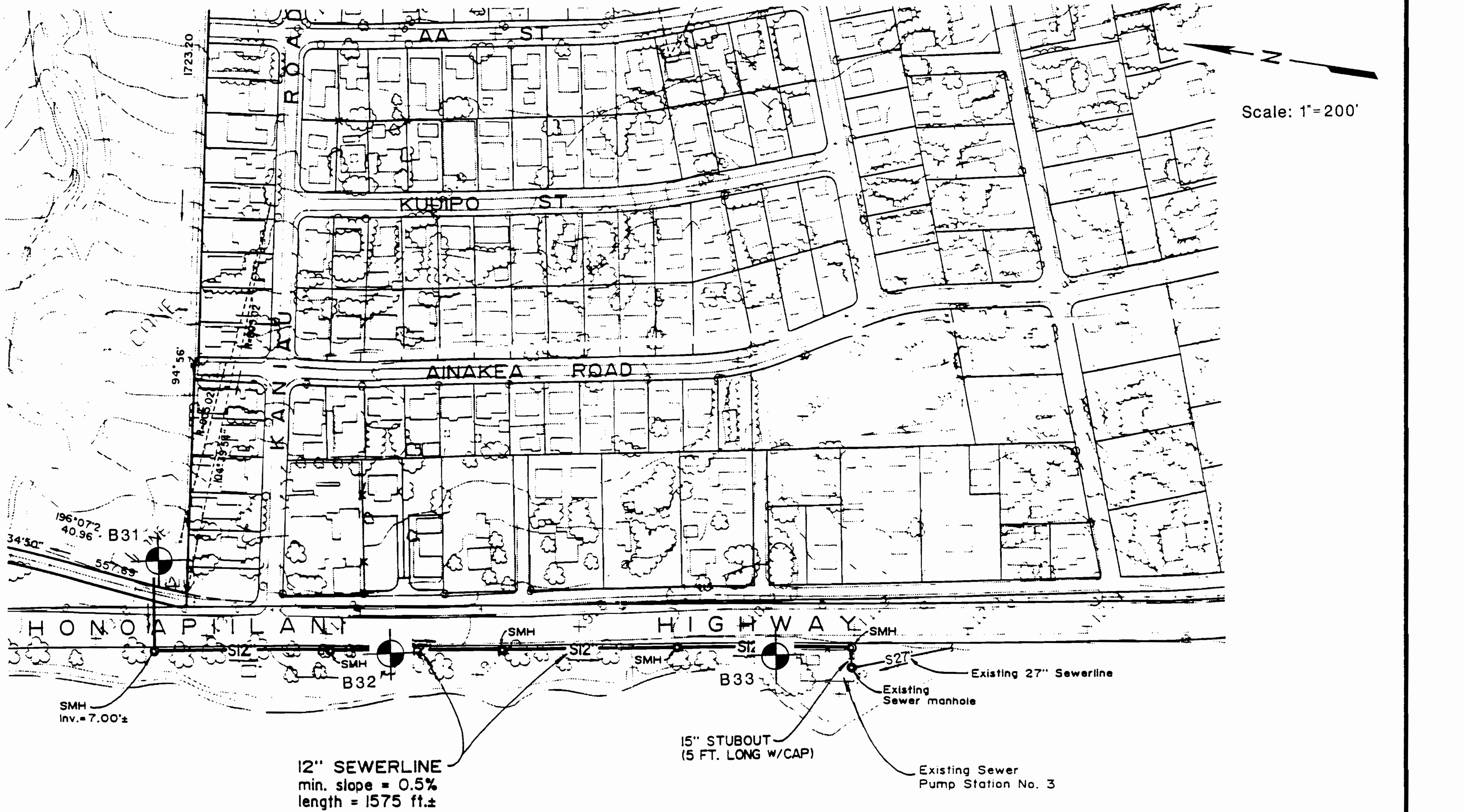


Reference: Compass Maps

W.O. 90-2044.2	Lahaina Project - Village I Phase A & Offsite Sewer Line
ERNEST K. HIRATA & ASSOCIATES, INC.	LOCATION MAP Plate 1



W.O. 90-2044.2	Village I Phase A - Lahaina Project
Ernest K. Hirata & Associates, Inc.	SITE PLAN Plate 2A



Approximate Location of Borings

W.O. 90-2044.2	Offsite Sewer Line - Lahaina Project
Ernest K. Hirata & Associates, Inc.	SITE PLAN

Plate 2B